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BRIEF REPORT

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Understanding the creator's intention helps 24- and 26-month-olds use picture mediated information as a guide for action

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Abstract

Toddlers show high sensitivity to creator's intention when they interpret pictures. Previous research suggest that toddlers' performance can be facilitated in a picture comprehension task by making available the creator's intention that is, the social origin of picture-creation. The present study aims to test the generalizability of this facilitative effect in two very young age groups (24- and 26-month-olds). In order to test how toddlers generalize their knowledge, we introduced a treatment in which the creator was intentionally drawing objects and a completely different test context with a retrieval task. The results suggest that two-year-olds can transfer their socially mediated knowledge of pictures to a novel problem solving test situation and contextualize pictures that does not contain any social cues.

Highlights

- We aimed to facilitate picture comprehension and to test the generalizability of this facilitative effect in two age groups.
- We introduced a treatment in which the creator was intentionally drawing and a different test context with a retrieval task.

- Two-year-olds can transfer their socially mediated knowledge of pictures to a novel problem solving test situation without any social cues.

KEYWORDS
creator's intention, knowledge transfer, picture comprehension, social cognition, toddlers

1 | INTRODUCTION

As pictures are a unique source of information and an important tool for indirect learning in human cultures, fully developed picture comprehension is at great importance for children. As pictures are intentionally created symbolic artifacts, picture comprehension requires the understanding that it is only a creator's intention that makes pictures symbolic (DeLoache, 2010). For this reason, in her model, DeLoache identified intentionality as a pivotal factor that contributes to representational insight, the recognition of picture-referent relation. Cultural comparative studies confirm that early social experience with pictures has a foundational role for developing explicit knowledge of the representational function of pictures (e.g., Callaghan, Rochat, & Corbit, 2012).

A large body of research supports that children's capacity to monitor a creator's intention is essential for an understanding of pictorial representations and develops until the age of 10. At the same time, sensitivity to the creator's intention emerges at a very early age (for review, see Allen & Armitage, 2017). Preissler and Bloom (2008) demonstrated that 26- to 33-month-olds could infer the referent of a drawing, by using the creator's intention manifested in his/her intentional drawing action and gaze behavior.

Acknowledging the significance of understanding the creator's intention, Callaghan and Rankin (2002) facilitated 31-to 32-month-olds's picture comprehension in a referent identification test, using a preceding 4-month-long training. In this training, they demonstrated that pictures originated from a creator's intention.

Egyed and Szalai (2016) also successfully facilitated even younger, 24-to 30-month-old's picture comprehension in a brief one-session Experimental treatment by making available the creator's intention to draw an object, that is, the creator's intention makes a picture symbolic. This socially mediated representational function of pictures enabled children in a subsequent test to use resemblance between the picture and the referent in order to solve a problem, that is, to contextualize pictures in the current reality. Note that both the Experimental and the Control treatment was a social situation in which children interacted with an intentionally behaving adult. However, while in the Experimental condition the adult intentionally drew pictures, in the Control condition she discovered pre-drawn pictures. Thus, the only difference was that while in the Experimental condition the representational function of pictures was socially mediated, in the Control condition it was not. Due to the Experimental treatment, children performed better in a subsequent picture retrieval task, which goes beyond Callaghan and Rankin's referent identification task because it requires children to contextualize picture mediated information as a guide for action in the current reality. Additionally, the facilitative effect took place in a test that utilized pre-drawn pictures without any social cue. At the same time, as the treatment and the test used the same setup (a dollhouse), it appears that the facilitative effect of the socially mediated representational function of pictures was limited to the context in which knowledge was acquired (Egyed & Szalai, 2016). Therefore, the question arises whether toddlers could transfer their freshly acquired knowledge about the representational function of pictures from the treatment to a novel context. Furthermore, although children's achievement was successfully facilitated in a retrieval task that required using pictures to solve problems in the current reality, it occurred in a relatively broad age-range of 24-to 30-months when previous research demonstrated rapid improvement even in spontaneous development (e.g., DeLoache & Burns, 1994). Thus, it is also an open

question whether more homogenous groups of younger toddlers within this age range might benefit from being exposed to the social context of creating a picture in the treatment.

Accordingly, the purpose of the present study is twofold: on the one hand, we aim to test the generalizability of the socially mediated understanding of the representational function of pictures by using two different contexts in the treatment and the test, including different tasks in the treatment (referent-picture matching) and the test (retrieval) with two sets of objects and pictures (Figure 1a,b). On the other hand, we explore the question of generalizability in two young age-groups. First, we investigate 26-month-olds since they were the youngest children within the age range of 26- to 33-months who could identify the referent of picture on the basis of the creator's intentional behavior (gazing and drawing action) (Preissler & Bloom, 2008). Accordingly, we predict that due to the Experimental treatment that makes the social origin of pictures available, 26-month-olds in the Experimental condition will perform better in the picture retrieval task than children in the Control condition. Second, we test 24-month-olds because they are frequently targeted in research on picture understanding, whereas the conclusion seems to be ambiguous. On the one hand, although toddlers at this age has made impressive progress toward becoming symbol-minded (e.g., DeLoache, 2002, 2004; Piaget, 1951; Vygotsky, 1962), it is a well-documented fact that 24-month-olds perform at chance level in the classical picture retrieval task, that is, they face a serious challenge when using pictures for problem solving (e.g., DeLoache, 1987, 2010); On the other hand, to our knowledge, there are three studies in which 24-month-olds' performance was successfully facilitated in a picture retrieval task (Peralta & Salsa, 2009; Suddendorf, 2003; Troseth, 2003). However, neither of these studies manipulated the understanding of the creator's intention as an underlying factor of picture comprehension. Nevertheless, two-year-olds could use the creator's intention if the intention was pedagogically demonstrated, namely, the creator verbally described her intention to represent the objects (Salsa & Vivaldi, 2016). However, this effect was shown in a task that required to match the drawings with their referent without contextualizing pictures and using them adaptively for problem solving. Additionally, similarly to Egyed and Szalai (2016), Salsa and Vivaldi (2016) did not test how 24-month-old could generalize their knowledge to a novel context. Thus, it is an open question whether 24-month-olds' performance can be facilitated in a retrieval task by making the social origin of pictures available to them if the retrieval task requires to transfer the understanding of representational function of picture from the treatment context to a novel one.

In sum, the present study aims to test generalizability of the understanding of the socially mediated representational function of pictures in two age groups, using two different contexts for the treatment and the test. The toddlers were tested in a between-subject design in which the Control and Experimental treatments were closely matched, and the same retrieval task was used in both conditions and age groups (Table 1). Additionally, the retrieval test did not contain any social cue regarding the social origin of the pictures but the pre-drawn pictures themselves.

2 | METHODS

2.1 | Participants

Forty children participated in the experiment, divided into two different age groups of 20 children each: 24-month-olds (M = 24.34 months, SD = .24); 26-month-olds (M = 26.22 months, SD = .47). Toddlers were primarily from Caucasian middle-class families recruited through advertisements. They were randomly assigned to either the Experimental (n = 20, 10 boys) or Control condition (n = 20, 10 boys). An additional 6 children were excluded because they failed to cooperate.

2.2 | Procedure

Each child participated individually in a 15–20-minute procedure with the experimenter (E) and the assistant, which was video-recorded for coding.

2.3 | Treatment phase

2.3.1 | Orientation

The Treatment began with the Orientation in both conditions: E invited the child to play and uncovered seven objects (four targets and three distractors, Figure 1a). Then E pointed at the objects and named them one by one.

2.3.2 | Warm-up

E presented an earring and named it. Afterwards, she removed a piece of paper from a folder but did not reveal it to the child. From that point on, the procedure was strictly matched in the two conditions except for variations in accordance with the research goal. In the Experimental condition, E pretended to draw the earring while she gazed back and forth from the earring to the drawing twice. In the Control condition the procedure was the same except that E was not drawing but discovered the pre-drawn picture. Then in both conditions E revealed the line drawing of the earring (photo converted by Photoshop), emphasized the similarity between the drawing and the object, and explained that the picture represented the earring.

2.3.3 | Four treatment trials

The Warm-up trial was followed by the Treatment in which the child was invited into a game. E took out a piece of paper from a folder. In the Experimental condition E made available her intention to create, saying: "Let's play something. I'm going to *draw* one of these objects on the table for you. Then you will point to the object that is in my drawing." While E was pretending to draw, she was looking back and forth at the objects twice. In the Control condition a slightly different instruction and procedure were used: "Let's play something, I'm going to *show* you a drawing of one of these objects on the table. Then you will show me which object is in the drawing." In the Control condition, E was not drawing but discovered the pre-drawn picture while she was looking back and forth at the objects twice. Then, in both conditions, E revealed the line drawing and asked the child to find its referent. As the objects on the table were placed close to each other, the referents were not identifiable on the basis of E's gaze. Children were to match each of four target objects to its pictorial

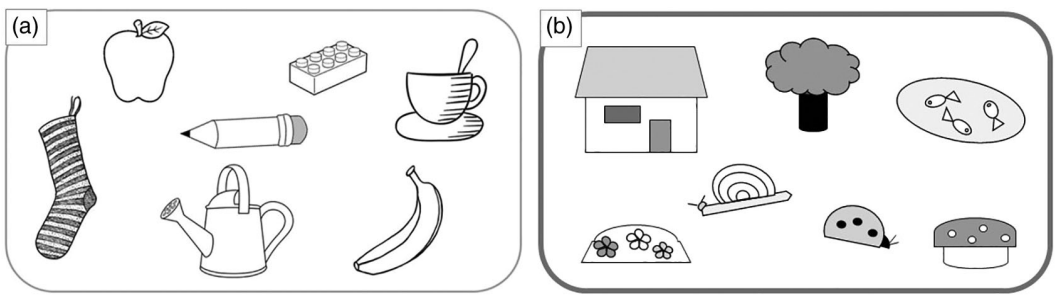

FIGURE 1 A line drawing illustration of the stimuli of (a) the treatment and (b) the test

TABLE 1 W. W. Norton & Company, New YorkThe summary of the procedure with the closely matched conditions

	Experimental condition	Control condition
Treatment phase		
Orientation	E points at the objects and names them one by one	
Warm-up trial	"I am going to draw you a picture." (declaration of intention) E draws a picture of the earring (intentional action). While drawing the picture, E looks back and forth twice (gaze behavior).	"I am going to show you a picture." (declaration of intention) E shows a picture of the earring (intentional action). While discovering the picture, E looks back and forth twice (gaze behavior).
	E stresses the similarity between the drawing and the object.	
4 trials	I'm going to draw you one of these objects (declaration of intention). E draws a picture (intentional action). While drawing a picture, she looks back and forth at the objects twice (gaze behavior).	I'm going to show you a drawing of one of these objects (declaration of intention). E discovers and shows a picture (intentional action). While discovering a picture, she looks back and forth at the objects twice (gaze behavior).
	The child participates in the process of identification of the target objects on the basis of the pictures.	
Test phase		
Orientation	E points and names each object in the garden.	
Warm-up	The child witnesses that E puts the ball under each of seven possible hiding places and s/he is supposed to retrieve the ball using his/her memory.	
Retrieval task	The child cannot witness where E hid the ball in the garden. The child is supposed to retrieve the target object using a *pre-drawn* picture.	

representation. If a child unsuccessfully matched, E identified the referent in each case. Note that both treatments ensured correct identification of specific referents four times. In addition, due to the closely matched design, each condition included the same sequence of procedural elements with the same timing: declaration of intentions and intentional actions with slight differences in the two conditions, and completely the same gaze behavior, four objects and their pictorial representations (photos converted by Photoshop) (Table 1).

2.4 | Test phase

The Test was the same retrieval task in both conditions and age groups, including four trials in random order and a new set of objects and their highly iconic color-pictures (photos converted by Photoshop) (Figure 1b).

2.4.1 | Orientation

E escorted the child to another table and uncovered the test stimuli: a toy garden (52 cm × 40 cm × 5 cm) with hiding places (four targets, three distractors, see Figure 1b), and two dolls. E introduced the dolls and pointed to and named each of the seven objects in the garden.

2.4.2 | Warm-up

Then E pretended that the two dolls were playing with the ball in the garden. E put the ball under each of seven possible hiding places and the child was supposed to retrieve it. follow the continuously visible ball.

2.4.3 | Retrieval task

E invited the child to play again, saying, "Let's play! I shall hide this ball in the garden and you will have to find it. Please turn away and cover your eyes!" The Assistant ensured that the child could not see the hiding process. Then E called to the child, saying, "I hid it. It is your turn. Look! Here is a drawing about the place where I hid the ball." Then E showed the child a picture of the garden with the hiding places. In each trial the ball was partially visible in a different hiding place. The child was asked to point to the ball in the picture in order to identify the location in the picture. Finally, E instructed the child, saying, "Yes, the ball is over there in the picture. You can find it in the same place in the garden. Please find the ball!" Note, the ball in the garden was fully covered.

2.5 | Coding

The toddler's behavior was coded offline. The response was correct if the child started to search based on the picture and found the ball. The coding system followed the procedure applied in previous studies (e.g., Egyed & Szalai, 2016; Sharon & DeLoache, 2003). To establish reliability a blind coder coded 60% of the sample. The agreement between coders was 96% (κ = .91). Disagreements were resolved by a third blind coder.

3 | RESULTS AND DISCUSSION

Regarding the order of the four trials, the Cochran's Q test showed no order effect in either the two age groups or the two conditions, which indicates that simply practicing the retrieval task did not result in a systematic increase in performance. The lack of order effect also suggests that the children were not using process of elimination, which would have made the later trials easier than earlier ones.

We compared the proportion of errorless retrievals from the four trials to chance performance in both conditions and both age groups. Chance was set at .14 based on the number of seven possible hiding places. The performance in the Experimental condition was significantly above chance level in both age groups (24-month-olds: $t(9) = 3.059$, $p = .014$; 26-month-olds: $t(9) = 6.684$, $p < .01$). At the same time, in the Control condition the performance was not significantly different from chance (24-month-olds: $t(9) = 1.71$, $p = .120$; 26-month-olds: $t(9) = 1.78$, $p = .108$. As reported in many previous studies, children in this age group performed at the level of chance in the Control condition (e.g., DeLoache & Burns, 1994), however, the performance in the Experimental condition exceeded the chance level in both age groups.

The children's retrieval performance was analyzed in a 2 (age group) × 2 (condition) × 2(gender) ANOVA. We found only a significant main effect of condition, $F(1, 32) = 6.081$, $p < .019$, partial $\eta^2 = .16$. Children in the experimental condition achieved a significantly higher score (48%; $M = 1.9$, $SD = .96$) than those in the Control condition (29%; $M = 1.15$, $SD = 1.04$) (see Table 2). On the one hand, a main effect of condition is in line with our prediction

TABLE 2 Means of errorless retrievals

Condition	Age group	*Mean*	*SD*
Experimental	24 m	1.5 (38%)	0.97
	26 m	2.3 (58%)	0.82
	$\sum$	1.9 (48%)	0.96
Control	24 m	1.1 (27%)	0.99
	26 ms	1.2 (30%)	1.13
	$\sum$	1.15 (29%)	1.04

because the socially mediated representational function of pictures in the Experimental treatment resulted in better picture comprehension. On the other hand, we found neither significant main effect of gender and age nor interactions. Together, these results suggest that children benefitted from the experimental treatment.

4 | GENERAL DISCUSSION

The present study undertook to test whether young toddlers can generalize their understanding of the socially mediated representational function of pictures to a novel context. We found that toddlers in the Experimental condition overperformed the children in the Control condition. Furthermore, both the 24-month-olds' and the 26-month-olds' performance exceeded the chance level in the Experimental condition. Thus, we successfully facilitated picture comprehension by manipulating the social context in which the pictures were created.

Salsa and Peralta de Mendoza (2007) also showed how children's intention-reading skill could contribute to the development of picture understanding. Specifically, they facilitated 30-month-olds' performance in a classical picture retrieval task by communicating that the intended function of picture was to help children using the picture as source of information.

In the present study, instead of communicating the helping intention of picture, we highlighted the creator's intention to represent objects in pictures. We successfully replicated the facilitative effect of socially mediated representational function of pictures (Egyed & Szalai, 2016) in two young age groups, which unambiguously shows that in picture comprehension even younger toddlers can benefit from the mentalistic understanding of a creator's drawing intention and action. Nevertheless, the facilitative effect occurred in a new design that utilized two completely different contexts in the treatment and the retrieval task. In this new design, we demonstrated the generalizability of the socially mediated understanding of representational function of pictures. That is, young toddlers in two age groups could transfer their freshly acquired general knowledge about the representational function of pictures to a novel context.

The transfer effect found in the present study is similar to that of previous research which provided evidence of knowledge transfer in a picture retrieval task (Peralta & Salsa, 2009; Troseth, 2003). While toddlers in Troseth's study successfully transferred across symbolic media—from video training and a video retrieval task to a real-time picture retrieval task—in Peralta and Salsa's study if children used pictures to communicate information, performed better in a picture retrieval task. Although in these investigations toddlers' achievement was undoubtedly higher than in the present study, yet, toddlers in the present study transferred their knowledge regarding the socially mediated representational function of pictures to a novel test-context with new objects and their pictures. Moreover, beyond the knowledge generalization, this transfer effect is especially remarkable for the following reasons: First, in contrast to Troseth's (2003) and Peralta and Salsa's (2009) study, children in the present study did not acquire experience with the retrieval task in the treatment phase. Second, the novel context of the retrieval task did not contain any cues concerning the social origin of the pictures. That is, toddlers used the test pictures as representations for problem solving even if the social origin of the pre-drawn pictures was not available. Third, the way that pictures were presented in the retrieval task was more similar to the treatment of the Control condition where pre-drawn pictures were found in a folder. This could have made the test easier for toddlers in the Control condition. However, based on the results, it is not the similarity of the treatment and test context that matters, but the treatment itself. At least, this explanation appears plausible, since toddlers in the Experimental condition outperformed toddlers in Control condition, even though the procedure in the treatment phase (i.e., “online drawing”) and that in the test (i.e., pre-drawn pictures) were less similar in the Experimental condition.

Note that both conditions used the same highly iconic pre-drawn test pictures for problem solving and they did not contain any cues concerning the social origin of the pictures. Thus, picture-referent resemblance was the only available cue for toddlers to find the hidden object. Interacting with highly iconic pictures that closely resemble what they refer to in the world is in accordance with children's everyday experience. Armitage and Allen (2015) found that

both children and adults gave appearance-based responses when identifying the referents of unambiguous pictures. Several studies have demonstrated that resemblance is critical in early picture-based learning and facilitates the generalization of pictorial information (e.g., DeLoache & Ganea, 2009; Ganea, Pickard, & DeLoache, 2008; Simcock & DeLoache, 2006). At the same time, in the classical retrieval task, 24-month-olds had serious difficulties even if the test pictures were highly iconic (DeLoache & Burns, 1994). This is in line with our result that the resemblance between a referent and the picture alone was not enough for the toddlers to efficiently search for the referent object in the Control condition. However, due to the socially mediated representational function of pictures toddlers performed better in identifying the referent of a picture and used this information in a subsequent picture retrieval task. Accordingly, the creator's verbally expressed intention in the treatment, which created a highly iconic picture, enabled toddlers to use resemblance in order to understand the representational function of pictures. Salsa and Vivaldi (2016) also found that 2-year-olds could use the resemblance between a drawing and an object if in a pedagogical context the creator verbally described her current or previous intention to represent an object. Nevertheless, the facilitative effect occurred not in a problem-solving situation but in a referent identification task in which toddlers were not required to generalize knowledge.

In sum, the present study shows that the social context—including the creator's intentions—could serve as a unique cue for 2-year-olds to understand pictures. More importantly, this socially mediated general knowledge of pictures can be transferred to a novel situation which does not contain any relevant social cues. Consequently, this mentalistic interpretation can make the picture-world relationship more transparent.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author.

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